

PATENT COOPERATION TREATY

PCT

INTERNATIONAL SEARCH REPORT

(PCT Article 18 and Rules 43 and 44)

Applicant's or agent's file reference 26728	FOR FURTHER ACTION	see Notification of Transmittal of International Search Report (Form PCT/ISA/220) as well as, where applicable, item 5 below.
International application No. PCT/AU 00/00722	International filing date (day/month/year) 26 June 2000	(Earliest) Priority Date (day/month/year) 25 June 1999
Applicant 1. J.P. KENNY PTY. LIMITED et al		

This international search report has been prepared by this International Searching Authority and is transmitted to the applicant according to Article 18. A copy is being transmitted to the International Bureau.

This international search report consists of a total of 5 sheets.



It is also accompanied by a copy of each prior art document cited in this report.

1. Basis of the report

a. With regard to the language, the international search was carried out on the basis of the international application in the language in which it was filed, unless otherwise indicated under this item.



the international search was carried out on the basis of a translation of the international application furnished to this Authority (Rule 23.1(b)).

b. With regard to any nucleotide and/or amino acid sequence disclosed in the international application, the international application, the international search was carried out on the basis of the sequence listing:



contained in the international application in written form.



filed together with the international application in computer readable form.



furnished subsequently to this Authority in written form.



furnished subsequently to this Authority in computer readable form.



the statement that the subsequently furnished written sequence listing does not go beyond the disclosure in the international application as filed has been furnished.



the statement that the information recorded in computer readable form is identical to the written sequence listing has been furnished

2. Certain claims were found unsearchable (See Box I).

3. Unity of invention is lacking (See Box II).

4. With regard to the title, the text is approved as submitted by the applicant.



the text has been established by this Authority to read as follows:

5. With regard to the abstract, the text is approved as submitted by the applicant



the text has been established, according to Rule 38.2(b), by this Authority as it appears in Box III.
The applicant may, within one month from the date of mailing of this international search report, submit comments to this Authority.

6. The figure of the drawings to be published with the abstract is Figure No. 3



as suggested by the applicant.



None of the figures



because the applicant failed to suggest a figure



because this figure better characterizes the invention

INTERNATIONAL SEARCH REPORT

International Application No.

PCT/AU 00/00722

Box I Observations where certain claims were found unsearchable (Continuation of item 2 of first sheet)

This international search report has not been established in respect of certain claims under Article 17(2)(a) for the following reasons:

1. Claims Nos.:
because they relate to subject matter not required to be searched by this Authority, namely:

2. Claims Nos.:
because they relate to parts of the international application that do not comply with the prescribed requirements to such an extent that no meaningful international search can be carried out, specifically:

3. Claims Nos.:
because they are dependent claims and are not drafted in accordance with the second and third sentences of Rule 6.4(a)

Box II Observations where unity of invention is lacking (Continuation of item 3 of first sheet)

This International Searching Authority found multiple inventions in this international application, as follows:

Claims 1 to 8 and 15 to 21 which are directed to the stabilisation of submarine elongate structure which include restraints and being anchored to the sea bed.

Claims 9 to 15 merely define a restraint device which is not limited to the stabilisation of submarine elongate structures and accordingly may be construed as anything from a channel sector to a pair of cable ties.

1. As all required additional search fees were timely paid by the applicant, this international search report covers all searchable claims
2. As all searchable claims could be searched without effort justifying an additional fee, this Authority did not invite payment of any additional fee.
- As only some of the required additional search fees were timely paid by the applicant, this international search report covers only those claims for which fees were paid, specifically claims Nos.:

4. No required additional search fees were timely paid by the applicant. Consequently, this international search report is restricted to the invention first mentioned in the claims; it is covered by claims Nos.:

1 to 8 and 16 to 21

Remark on Protest

The additional search fees were accompanied by the applicant's protest.

No protest accompanied the payment of additional search fees.

INTERNATIONAL SEARCH REPORT

International application No.

PCT/AU 00/00722

A. CLASSIFICATION OF SUBJECT MATTER

Int Cl⁷: F16L 1/16, 1/20, 1/23, 1/24

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

IPC F16L 1/16, 1/20, 1/23, 1/24

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched
AU: IPC as above

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	WO 9301438,A; (CANADIAN RUBBER & STEEL LTD) 21 January 1993 See entire document.	
A	US 4242010,A, (GJERDE et al) 30 December 1980 See entire document.	
A	AU 59533/73 (462867) B (MARCONA CORPORATION) 20 March 1975 See entire document.	

 Further documents are listed in the continuation of Box C See patent family annex

* Special categories of cited documents:

"A" Document defining the general state of the art which is not considered to be of particular relevance
 "E" earlier application or patent but published on or after the international filing date
 "L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)
 "O" document referring to an oral disclosure, use, exhibition or other means
 "P" document published prior to the international filing date but later than the priority date claimed

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention
 "X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone
 "Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art
 "&" document member of the same patent family

Date of the actual completion of the international search

07 August 2000

Date of mailing of the international search report

Name and mailing address of the ISA/AU
 AUSTRALIAN PATENT OFFICE
 PO BOX 200
 WODEN ACT 2606 AUSTRALIA
 E-mail address: pct@ipaaustralia.gov.au
 Facsimile No.: (02) 6285 3929

Authorized officer

R. WEBER

Telephone No.: (02) 6283 2546

INTERNATIONAL SEARCH REPORT

International application No.

PCT/AU 00/00722

C (Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT		
Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	US 4338045, A, (COUR) 6 July 1982 See entire specification	
X	WO 8911055, A, (TELE BETONG A/S) 16 November 1989 See entire specification	1 to 8,16,17,18
X	WO 92 20947, A, (DEN NORSKE STATS OLJESELSKAP AS) 26 November 1992 See entire specification	1 to 8, 16,17,18
X	WO 9720160,A, (COFLEXIP STENA OFFSHORE LIMITED) 5 June 1997 See entire specification	1 to 8, 16,17,18
X	US 5603588, A, (HERBERT) 18 February 1997 See entire specification	1 to 8,16,17,18
X	DE 4222789, C, (JOSEF RIEPL BAU-AKTIENGESELLSCHAFT) 13 May 1993 See entire spectrum	1 to 8,16,17,18

INTERNATIONAL SEARCH REPORT**Information on patent family members**International application No.
PCT/AU 00/00722

This Annex lists the known "A" publication level patent family members relating to the patent documents cited in the above-mentioned international search report. The Australian Patent Office is in no way liable for these particulars which are merely given for the purpose of information.

Patent Document Cited in Search Report				Patent Family Member			
WO	9301438	AU	23006/92	CA	2053747	EP	594642
		NO	940047	US	5263796		
US	4242010	AU	39116/78	CA	1093323	DE	2836189
		DK	3668/78	GB	2005792	JP	54063530
		NL	7808593	NO	772898	NO	781557
AU	59333/73	US	3779027				
US	4338045	AR	229232	AU	58572/80	BE	883466
		BR	8003205	DK	1911/80	EP	20232
		ES	491703	ES	8102615	FR	2457428
		JP	56006971	NO	801513	FR	2468820
		FR	2469635				
WO	8911055	AU	37338/89	DK	2164/89	NO	881971
		SE	8901592				
WO	9220947	AU	16956/92	NO	912018		
WO	972160	AU	76351/96	BR	9611616	EP	861396
		NO	982303				
US	5603588	AU	69218/96	CA	2158801	WO	9711299
DE	4222789	CH	687344				

END OF ANNEX

PCT COOPERATION TREATY

From the INTERNATIONAL BUREAU

PCT

NOTIFICATION OF ELECTION
(PCT Rule 61.2)

Date of mailing (day/month/year)
26 February 2001 (26.02.01)

To:
Commissioner US Department of Commerce United States Patent and Trademark Office, PCT 2011 South Clark Place Room CP2/5C24 Arlington, VA 22202 ETATS-UNIS D'AMERIQUE
in its capacity as elected Office

International application No.	Applicant's or agent's file reference
PCT/AU00/00722	9165/26728
International filing date (day/month/year)	Priority date (day/month/year)
26 June 2000 (26.06.00)	25 June 1999 (25.06.99)

Applicant
ELLIS, Barry, Errol et al

1. The designated Office is hereby notified of its election made:

in the demand filed with the International Preliminary Examining Authority on:

28 December 2000 (28.12.00)

in a notice effecting later election filed with the International Bureau on:

2. The election was

was not

made before the expiration of 19 months from the priority date or, where Rule 32 applies, within the time limit under Rule 32.2(b).

The International Bureau of WIPO
34, chemin des Colombettes
1211 Geneva 20, Switzerland

Facsimile No.: (41-22) 740.14.35

Authorized officer

A. Karkachi

Telephone No.: (41-22) 338.83.38

P. P. T. COOPERATION TREATY

PCT

NOTIFICATION OF THE RECORDING
OF A CHANGE(PCT Rule 92bis.1 and
Administrative Instructions, Section 422)

From the INTERNATIONAL BUREAU

To:

WRAY & ASSOCIATES
239 Adelaide Terrace
Perth, W.A. 6000
AUSTRALIE

Date of mailing (day/month/year) 26 February 2001 (26.02.01)	
Applicant's or agent's file reference 9165/26728	IMPORTANT NOTIFICATION
International application No. PCT/AU00/00722	International filing date (day/month/year) 26 June 2000 (26.06.00)

1. The following indications appeared on record concerning:

the applicant the inventor the agent the common representative

Name and Address FOGLIANI, Antonio, John 19 Mullewa Crescent Coolbinia, W.A. 6050 Australia	State of Nationality AU	State of Residence AU
	Telephone No.	
	Facsimile No.	
	Teleprinter No.	

2. The International Bureau hereby notifies the applicant that the following change has been recorded concerning:

the person the name the address the nationality the residence

Name and Address FOGLIANI, Antonio, John 19 Mullewa Crescent Coolbinia, W.A. 6050 Australia	State of Nationality AU	State of Residence AU
	Telephone No.	
	Facsimile No.	
	Teleprinter No.	

3. Further observations, if necessary:

4. A copy of this notification has been sent to:

<input checked="" type="checkbox"/> the receiving Office	<input type="checkbox"/> the designated Offices concerned
<input type="checkbox"/> the International Searching Authority	<input checked="" type="checkbox"/> the elected Offices concerned
<input checked="" type="checkbox"/> the International Preliminary Examining Authority	<input type="checkbox"/> other:

The International Bureau of WIPO 34, chemin des Colombettes 1211 Geneva 20, Switzerland Facsimile No.: (41-22) 740.14.35	Authorized officer A. Karkachi Telephone No.: (41-22) 338.83.38
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3
INTERNATIONAL COOPERATION TREATY
PCT
INTERNATIONAL PRELIMINARY EXAMINATION REPORT
(PCT Article 36 and Rule 70)

REC'D 16 JUL 2001
WIPO PCT

Applicant's or agent's file reference 9165/26728	FOR FURTHER ACTION	See Notification of Transmittal of International Preliminary Examination Report (Form PCT/IPEA/416).
International application No. PCT/AU 00/00722	International filing date (<i>day/month/year</i>) 26 June 2000	Priority Date (<i>day/month/year</i>) 25 June 1999
International Patent Classification (IPC) or national classification and IPC Int. Cl.⁷ F16L 1/16, 1/20, 1/23, 1/24		
<p>Applicant 1. J.P. KENNY PTY. LIMITED et al</p>		

1. This international preliminary examination report has been prepared by this International Preliminary Examining Authority and is transmitted to the applicant according to Article 36.
2. This REPORT consists of a total of 6 sheets, including this cover sheet. <input type="checkbox"/> This report is also accompanied by ANNEXES, i.e., sheets of the description, claims and/or drawings which have been amended and are the basis for this report and/or sheets containing rectifications made before this Authority (see Rule 70.16 and Section 607 of the Administrative Instructions under the PCT).
These annexes consist of a total of 0 sheet(s).
3. This report contains indications relating to the following items:
I <input checked="" type="checkbox"/> Basis of the report II <input type="checkbox"/> Priority III <input type="checkbox"/> Non-establishment of opinion with regard to novelty, inventive step and industrial applicability IV <input checked="" type="checkbox"/> Lack of unity of invention V <input checked="" type="checkbox"/> Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement VI <input type="checkbox"/> Certain documents cited VII <input checked="" type="checkbox"/> Certain defects in the international application VIII <input type="checkbox"/> Certain observations on the international application

Date of submission of the demand 28 December 2000	Date of completion of the report 04 July 2001
Name and mailing address of the IPEA/AU AUSTRALIAN PATENT OFFICE PO BOX 200 WODEN ACT 2606 AUSTRALIA E-mail address: pct@ipaustralia.gov.au Facsimile No. (02) 6285 3929	Authorized Officer  R. WEBER Telephone No. (02) 6283 2546

I. Basis of the report

1. With regard to the elements of the international application:*

the international application as originally filed.

the description, pages , as originally filed,
 pages , filed with the demand,
 pages , received on with the letter of .

the claims, pages , as originally filed,
 pages , as amended (together with any statement) under Article 19,
 pages , filed with the demand,
 pages , received on with the letter of .

the drawings, pages , as originally filed,
 pages , filed with the demand,
 pages , received on with the letter of .

the sequence listing part of the description:
 pages , as originally filed
 pages , filed with the demand
 pages , received on with the letter of .

2. With regard to the language, all the elements marked above were available or furnished to this Authority in the language in which the international application was filed, unless otherwise indicated under this item.
These elements were available or furnished to this Authority in the following language which is:

the language of a translation furnished for the purposes of international search (under Rule 23.1(b)).

the language of publication of the international application (under Rule 48.3(b)).

the language of the translation furnished for the purposes of international preliminary examination (under Rules 55.2 and/or 55.3).

3. With regard to any nucleotide and/or amino acid sequence disclosed in the international application, the international preliminary examination was carried out on the basis of the sequence listing:

contained in the international application in written form.

filed together with the international application in computer readable form.

furnished subsequently to this Authority in written form.

furnished subsequently to this Authority in computer readable form.

The statement that the subsequently furnished written sequence listing does not go beyond the disclosure in the international application as filed has been furnished.

The statement that the information recorded in computer readable form is identical to the written sequence listing has been furnished

4. The amendments have resulted in the cancellation of:

the description, pages

the claims, Nos.

the drawings, sheets/fig

5. This report has been established as if (some of) the amendments had not been made, since they have been considered to go beyond the disclosure as filed, as indicated in the Supplemental Box (Rule 70.2(c)).**

* Replacement sheets which have been furnished to the receiving Office in response to an invitation under Article 14 are referred to in this report as "originally filed" and are not annexed to this report since they do not contain amendments (Rules 70.16 and 70.17).

** Any replacement sheet containing such amendments must be referred to under item 1 and annexed to this report

IV. Lack of unity of invention

1. In response to the invitation to restrict or pay additional fees the applicant has:
 - restricted the claims.
 - paid additional fees.
 - paid additional fees under protest.
 - neither restricted nor paid additional fees.
2. This Authority found that the requirement of unity of invention is not complied with and chose, according to Rule 68.1, not to invite the applicant to restrict or pay additional fees.
3. This Authority considers that the requirement of unity of invention in accordance with Rules 13.1, 13.2 and 13.3 is
 - complied with.
 - not complied with for the following reasons:

The international application does not comply with the requirements of unity of invention because it does not relate to one invention or to a group of inventions so linked as to form a single general inventive concept. In coming to this conclusion the International Preliminary Authority has found that there are two inventions:-

1. Claims 1 to 8 and 15 to 21 which are directed to the stabilisation of submarine elongated structures which includes restraints and being anchored to the seabed.
2. Claim 9 to 14 merely define a restraint device which is not limited to the stabilisation of submarine elongated structures and, accordingly, may be constructed as being anything from a channel selection to a pair of cable ties.

Since the above mentioned groups of claims do not share a special technical feature between the inventions as defined in PCT rule 13.2 'a technical relationship" does not exist. Accordingly the international application does not relate to one invention or to the International Search report and hence claims 9 to 14 cannot be meaningfully examined.

4. Consequently, the following parts of the international application were the subject of international preliminary examination in establishing this report:
 - all parts.
 - the parts relating to claims Nos. **1 to 8 and 16 to 21**

V. Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement

1. Statement

Novelty (N)	Claims 19, 20, 21 Claims 1 to 8, 16, 17, 18	YES NO
Inventive step (IS)	Claims 19, 20, 21 Claims 1 to 8 16, 17, 18	YES NO
Industrial applicability (IA)	Claims 1 to 8 16 to 21 Claims	YES NO

2. Citations and explanations (Rule 70.7)

Novelty (N) Claims 1 to 8, 16, 17, 18

WO 8911055 A, WO 9220947 A, WO 9720160, US5603588 A and DE 4222789 C.

The above citations disclose stabilisation means conforming exactly with that as defined in claims 1 to 8 and 16, 17 and 18. Further, the explicit teaching of each citation is to employ the stabilisation means as presently claimed.

Inventive Step (IS) Claims 1 to 8, 16, 17, 18.

Claims 1 to 8, 16, 17, 18 as above.

Industrial Applicability (IA) Claims 1 to 8, 16 to 21.

Claims 1 to 8, 18 to 21 are all considered to be industrially applicable.

VII. Certain defects in the international application

The following defects in the form or contents of the international application have been noted:

Claims 19, 20 and 21 are deficient in that they rely on a reference to the description and drawings (Rule 6.2(a))

Supplemental Box

(To be used when the space in any of the preceding boxes is not sufficient)

Continuation of :

(12) INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

(19) World Intellectual Property Organization
International Bureau



(43) International Publication Date
4 January 2001 (04.01.2001)

PCT

(10) International Publication Number
WO 01/01028 A3

(51) International Patent Classification⁷: F16L 1/16, 1/20, 1/23, 1/24 FOGLIANI, Antonino, John [AU/AU]; 19 Mullewa Crescent, Coolbinia, W.A. 6050 (AU).

(21) International Application Number: PCT/AU00/00722 (74) Agent: WRAY & ASSOCIATES; 239 Adelaide Terrace, Perth, W.A. 6000 (AU).

(22) International Filing Date: 26 June 2000 (26.06.2000)

(25) Filing Language: English

(26) Publication Language: English

(30) Priority Data: PQ 1196 25 June 1999 (25.06.1999) AU

(71) Applicant (for all designated States except US): J P KENNY PTY LIMITED [AU/AU]; 7th Floor, St Georges Square, 225 St Georges Terrace, Perth, W.A. 6000 (AU).

(72) Inventors; and

(75) Inventors/Applicants (for US only): ELLIS, Barry, Errol [AU/AU]; 7 Milne Street, Bicton, W.A. 6157 (AU).

(81) Designated States (national): AU, US.

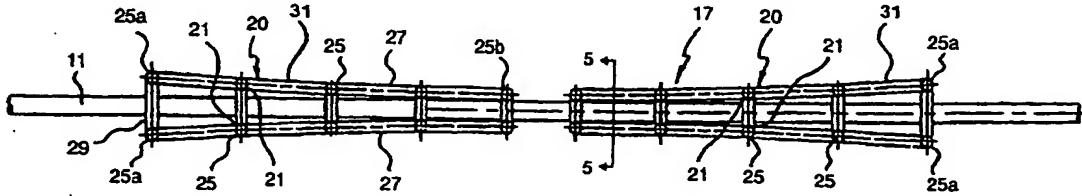
(84) Designated States (regional): European patent (AT, BE, CH, CY, DE, DK, ES, FI, FR, GB, GR, IE, IT, LU, MC, NL, PT, SE).

Published:
— With international search report.

(88) Date of publication of the international search report: 31 May 2001

For two-letter codes and other abbreviations, refer to the "Guidance Notes on Codes and Abbreviations" appearing at the beginning of each regular issue of the PCT Gazette.

(54) Title: STABILISATION OF SUBMARINE ELONGATE STRUCTURES



WO 01/01028 A3

(57) Abstract: A stabilisation system (10) for a section of a submarine pipeline (11) comprising an end restraint (15) at each end of the section of the pipeline and intermediate restraints (20) between the two end restraints (15) for limiting lateral movement of the pipeline (11) at the location of the restraints (15, 20). Each end restraint (15) is adapted to be secured to the pipeline (11) to transfer axial tension generated by lateral movement of the pipeline (11) to the seabed or ground on which the end restraint is installed. Each restraint (15, 20) comprises a pair of restraint faces (21) spaced apart to define a gap (23) through which the pipeline (11) can extend. Each restraint face (21) is configured to control curvature of the pipeline (11) during lateral movement thereof. A restraint device and a method of stabilising a submarine pipeline is also disclosed and claimed.

Title

"Stabilisation Of Submarine Elongate Structures"

Field Of The Invention

This invention relates to stabilisation of submarine elongate structures, such as
5 pipelines including single and multiple pipelines (bundled and unbundled),
umbilicals, cables, and other service conduits.

Background Art

Submarine elongate structures, and in particular submarine pipelines, can
become unstable through exposure to environmental influences, particularly
10 hydrodynamic loads arising from underwater currents and wave action. These
hydrodynamic loads typically increase in regions of shallow water. The
combination of extreme environmental loads and shallow water are present in
Australian waters, typically on the North West Shelf off the West Australian coast.

Various systems are currently utilised for submarine pipeline stabilisation,
15 including weight coatings on pipelines, coverings on pipelines, installation of
pipelines in trenches in the seabed, and securing pipelines to the seabed by way
of mechanical anchors. Various deficiencies and problems can be associated with
each of these stabilisation systems. For example, weight coating requirements for
pipelines can be very high or impracticable. Trenching of pipelines is required to
20 be deep in the seabed. Coverings over the pipeline need to be thick and of
adequate weight, and in some cases the covering material may itself be unstable.
Mechanical anchors of high capacity are required at close intervals to secure the
pipelines to the seabed.

While the abovementioned systems can be utilised in many situations, there are
25 locations where the cost involved can be very high or indeed prohibitive, and the
installation procedure can be time-consuming.

It is against this background, and the deficiencies and problems associated therewith, that the present invention has been developed.

DISCLOSURE OF THE INVENTION

The present invention provides a stabilisation system for a section of a submarine

5 elongate structure comprising an end restraint at each end of the section of the elongate structure, each end restraint being adapted to be secured to the elongate structure to transfer axial tension generated by lateral movement of the elongate structure to the seabed or ground on which the end restraint is installed, each restraint comprising a pair of restraint faces spaced apart to define a gap

10 through which the elongate structure can extend, each face being configured to control curvature of the elongate structure during lateral movement thereof.

At least one intermediate restraint may be provided between the two end restraints for limiting lateral movement of the structure at the location of the intermediate restraint.

15 The restraint locations provided by the end restraints and any intermediate restraint therebetween are spaced sufficiently to allow the elongate structure to move laterally and develop axial tension until an equilibrium position is achieved. The restraint locations are selected so as to maintain axial tensions (and associated axial stresses) within allowable limits and to ensure that the extent of

20 lateral movement of the elongate structure between the restraint locations is within an allowable range.

The configuration of the two restraint faces of each restraint allows the elongate structure to curve to one side or the other at the restraint location (depending on the direction of lateral movement) while limiting the maximum extent of curvature.

25 Preferably, each restraint face is curved.

Each restraint face can be either a continuous face, or a discontinuous face in the sense that it comprises a plurality of restraint zones disposed in the required

configuration. Each restraint zone may be defined by a restraint column embedded in the seabed or ground. The columns may be connected one to the other to provide an integral restraint structure.

The present invention further provides a stabilisation system for a section of a
5 submarine elongate structure comprising an end restraint at each end of the section of the elongate structure and at least one intermediate restraint between the two end restraints for limiting lateral movement of the structure at the location of the restraint, each end restraint being adapted to be secured to the elongate structure to transfer axial tension generated by lateral movement of the elongate
10 structure to the seabed or ground on which the end restraint is installed, each restraint comprising a pair of restraint faces spaced apart to define a gap through which the elongate structure can extend, each face being configured to control curvature of the elongate structure during lateral movement thereof.

The invention also provides a restraint device comprising a pair of restraint faces
15 spaced apart to define a gap therebetween to receive a section of an elongate structure, each restraint face being configured to control curvature of the elongate structure during lateral deflection thereof.

Each restraint face of the restraint device may be of a construction as set forth above in relation to the stabilisation system according to the invention.

20 The or each intermediate restraint used in the stabilisation system according to the invention may comprise a restraint device as defined above.

Each end restraint used in the stabilisation system according to the invention may comprise a restraint device as defined above together with a collar structure adapted to be secured to the elongate structure and bear on the restraint device
25 to transfer axial loading thereto.

The invention also provides a method of stabilising a submarine elongate structure comprising the steps of: anchoring two axially spaced apart sections of the elongate structure to the seabed or ground using end restraints, each restraint

presenting two restraint faces on opposed sides of the elongate structure, each restraint face being of a configuration for limiting curvature of the elongate structure.

5 The method may further include the step of installing one or more intermediate restraints between the two end restraints.

The invention still further provides a method of stabilising a submarine elongate structure comprising the steps of: anchoring two axially spaced apart sections of the elongate structure to the seabed or ground using end restraints, and installing one or more intermediate restraints between the two end restraints; each restraint 10 presenting two restraint faces on opposed sides of the elongate structure, each restraint face being of a configuration for limiting curvature of the elongate structure.

BRIEF DESCRIPTION OF THE DRAWINGS

15 The invention will be better understood by reference to the following description of one specific embodiment thereof as shown in the accompanying drawings in which:

Figure 1 is a schematic plan view of a section of a pipeline fitted with a stabilisation system according the embodiment;

Figure 2 is an elevational view of Figure 1;

20 Figure 3 is a fragmentary plan view of the pipeline, showing a pair of intermediate restraint devices;

Figure 4 is a side elevational view of Figure 3;

Figure 5 is a sectional view on line 5-5 of Figure 3;

25 Figure 6 is a fragmentary plan view of the pipeline showing an end restraint;

Figure 7 is a fragmentary plan view of part of the end restraint,

Figure 8 is a side view of Figure 7;

Figure 9 is an end view of the collar structure; and

Figure 10 is a sectional view on line 10-10 of Figure 6.

5 BEST MODE(S) FOR CARRYING OUT THE INVENTION

The embodiment shown in the drawings is directed to a stabilisation system 10 for stabilising a submarine pipeline 11 supported on a seabed 13 below water level 14.

10 The stabilisation system 10 includes two end restraints 15, one at each end of the section of the pipeline requiring stabilisation (only one of the restraints 15 being shown in the drawings). The pipeline stabilisation system 10 further includes a plurality of intermediate restraints 17 positioned at intervals along the length of the pipeline 11. The intermediate restraints comprise restraint devices 20 are positioned in pairs, as will be explained in detail later.

15 The end restraints 15 are secured to the pipeline section to transfer axial tension, generated by lateral movement of the pipeline, to the seabed or the ground on which the end restraints 15 are installed. Typically, each end restraint 15 would be positioned on the seabed 13 as shown in the drawings, but it may be positioned on the ground (shoreline) at a location where the pipeline enters or exits the water,

20 As mentioned above, the intermediate restraint devices 20 are positioned in pairs, as best seen in Figures 3 and 4 of the drawings. The intermediate restraint devices 20 are positioned in pairs in order to facilitate installation. In the event that larger capacity installation equipment is used, a combined single unit may be used.

Each restraint device 20 comprises two opposed restraint faces 21 in spaced apart relationship to define a gap 23 therebetween through which the pipeline 11 extends. In this embodiment, each restraint face 21 is defined by a plurality of spaced apart columns 25, at least some of which are embedded in the seabed 13,

5 as best seen in Figures 4 and 5. With this arrangement, each column 25 defines a restraint zone for restraining lateral movement of the pipeline.

The columns 25 are arranged in a curved formation so that the restraint face 21 that they define is of a curved configuration, as best seen in Figure 3 of the drawings. The columns 25a at one end are furthest apart and the columns 25b at

10 the other end are closest together, so that the gap 23 between the faces 21 progressively increases from one end to the other. The upper ends of the columns 25 are interconnected by longitudinal elements 27 and transverse elements 29. With this arrangement, the combination of the columns 25 together with the longitudinal elements 27 and transverse elements 29 form a unitary structure 31.

15 The two restraint devices 20 in each pair are positioned such that the end columns 25b are adjacent each other and the corresponding restraint faces 21 in alignment. With this arrangement, the two restraint devices 20 co-operate to control the extent to which the pipeline 11 can curve to one lateral side or the other at the location at which the two restraint devices 20 are installed. This

20 control is achieved by the curvature of the restraint faces 21.

Each of the end restraints 15 comprise a restraint device 40 of similar construction to the restraint devices 20, and a restraining collar structure 43 secured to the pipeline 11. As restraint device 40 is of similar construction to restraint device 20, similar reference numerals are used to identify like parts. The collar structure 43

25 presents an abutting face 45 which bears against the columns 25b which are positioned closest together. Co-operation between each collar structure 43 and the restraint device 40 against which it bears serves to transfer axial tension generated by lateral movement of the pipeline 11 to the seabed 13 (or ground) in which the restraint device 40 is anchored. The curved restraint faces 21 control

30 the extent to which the pipeline 11 can curve at the end restraint 15.

The collar structure 43 is of split construction comprising two parts which can be bolted or otherwise secured together around the pipeline to clampingly engage the pipeline. Such an arrangement is particularly suitable in cases when the 5 stabilisation system 10 is fitted to an existing pipeline. In cases when the stabilisation system is fitted during installation of a new pipeline, the collar structure may be welded or otherwise secured to the pipeline.

The end restraints 15 are positioned at the ends of the pipeline section to be stabilised and the intermediate restraint devices 20 are positioned in pairs at appropriate intervals between the end restraints 15. Typically, the spacing 10 between each end restraint 15 and the adjacent intermediate restraint 17, and the spacing between intermediate restraints 17, could be in the order of one kilometre or more. Associated lateral movements of the pipeline 11 between the restraint locations can be in the order of 20 metres or more. This compares with conventional restraint systems where restraint locations have spacings in the 15 order of 20 metres and have negligible movement of the restrained pipeline between the restrained locations.

The fact that the restraint system according to the embodiment can have restraint locations at significantly greater spacings than conventional arrangements allows installation in considerably less time and at a considerably lower cost.

20 The feature whereby the restraint faces 21 in the end restraints 15 and in the intermediate restraints 17 control the extent to which the pipeline 11 can curve as it undergoes lateral movement, permits the use of restraint locations at significantly increased spacings in comparison to conventional arrangements.

25 In operation, the curved restraint faces 21 support the pipeline 11 as it undergoes lateral movement and control the extent to which the pipeline can bend, thereby restraining lateral movement of the pipeline and stabilising the pipeline by ensuring that the lateral movement and the associated pipeline stresses are within allowable limits.

From the foregoing, it is evident that the present invention provides a simple yet highly effective arrangement for stabilisation of submarine pipelines and other like structures

It should be appreciated that the scope of the invention is not limited to the scope

5 of the embodiment described. There are, for example, instances where intermediate restraints would not be required between the end restraints. One such instance may be where a pipeline is relatively short (for example up to 1 km long). In such a case, the two end restraints are likely to work effectively without the need for any intermediate restraint.

10 Throughout the specification, unless the context requires otherwise, the word "comprise" or variations such as "comprises" or "comprising", will be understood to imply the inclusion of a stated integer or group of integers but not the exclusion of any other integer or group of integers.

THE CLAIMS DEFINING THE INVENTION ARE AS FOLLOWS

1. A stabilisation system for a section of a submarine elongate structure, comprising an end restraint at each end of the section of the elongate structure, each end restraint being adapted to be secured to the elongate structure to transfer axial tension generated by lateral movement of the elongate structure to the seabed or ground on which the end restraint is installed, each restraint comprising a pair of restraint faces spaced apart to define a gap through which the elongate structure can extend, each face being configured to control curvature of the elongate structure during lateral movement thereof.
2. A stabilisation system according to claim 1 wherein at least one intermediate restraint is provided between the two end restraints for limiting lateral movement of the structure at the location of the intermediate restraint.
3. A stabilisation system according to claim 1 or 2 wherein each restraint face is curved.
4. A stabilisation system according to claim 1, 2 or 3 wherein each restraint face comprises a continuous face.
5. A stabilisation system according to claim 1, 2 or 3 wherein each restraint face comprises a discontinuous face defined by a plurality of restraint zones disposed in the required configuration.
6. A stabilisation system according to claim 5 wherein each restraint zone is defined by a restraint column adapted to be embedded in the seabed or ground.
7. A stabilisation system according to claim 6 wherein the columns are connected one to the other to provide an integral restraint structure.

8. A stabilisation system for a section of a submarine elongate structure comprising an end restraint at each end of the section of the elongate structure and at least one intermediate restraint between the two end restraints for limiting lateral movement of the structure at the location of the restraint, each end restraint being adapted to be secured to the elongate structure to transfer axial tension generated by lateral movement of the elongate structure to the seabed or ground on which the end restraint is installed, each restraint comprising a pair of restraint faces spaced apart to define a gap through which the elongate structure can extend, each face being configured to control curvature of the elongate structure during lateral movement thereof.
9. A restraint device comprising a pair of restraint faces spaced apart to define a gap therebetween to receive a section of an elongate structure, each restraint face being configured to control curvature of the elongate structure during lateral deflection thereof.
10. A restraint device according to claim 9 wherein each restraint face is curved.
11. A restraint device according to claim 9 or 10 wherein each restraint face comprises a continuous face.
- 20 12. A restraint device according to claim 9 or 10 wherein each restraint device comprises a discontinuous face defined by a plurality of restraint zones disposed in the required configuration.
- 25 13. A restraint device according to claim 12 wherein each restraint zone is defined by a restraint column adapted to be embedded in the seabed or ground.
14. A restraint device according to claim 13 wherein the columns are connected one to the other to provide an integral restraint structure.

15. A stabilisation system according to claim 8 wherein each end restraint comprises a restraint device according to any one of claims 9 to 14, together with a collar structure adapted to be secured to the elongate structure and bear on the end restraint device to transfer axial loading thereto.

5

16. A method of stabilising a submarine elongate structure comprising the steps of: anchoring two axially spaced apart sections of the elongate structure to the seabed or ground using end restraints, each restraint presenting two restraint faces on opposed sides of the elongate structure, each restraint face being of a configuration for limiting curvature of the elongate structure.

10

17. A method according to claim 16 further comprising the step of installing one or more intermediate restraints between the two end restraints.

15

18. A method of stabilising a submarine elongate structure comprising the steps of: anchoring two axially spaced apart sections of the elongate structure to the seabed or ground using end restraints, and installing one or more intermediate restraints between the two end restraints; each restraint presenting two restraint faces on opposed sides of the elongate structure, each restraint face being of a configuration for limiting curvature of the elongate structure.

20

19. A stabilisation system substantially as herein described with reference to the accompanying drawings.

20. A restraint device substantially as herein described with reference to the accompanying drawings.

25

21. A method of stabilising a submarine elongate structure substantially as herein described.

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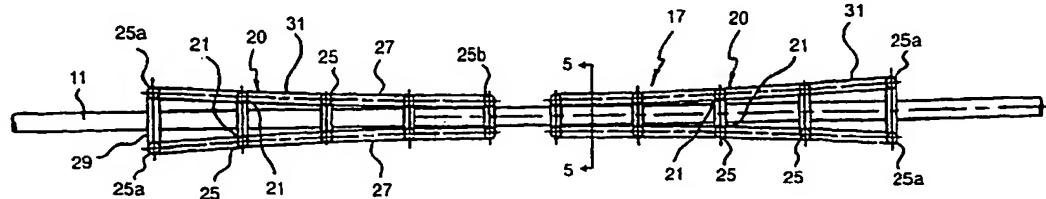
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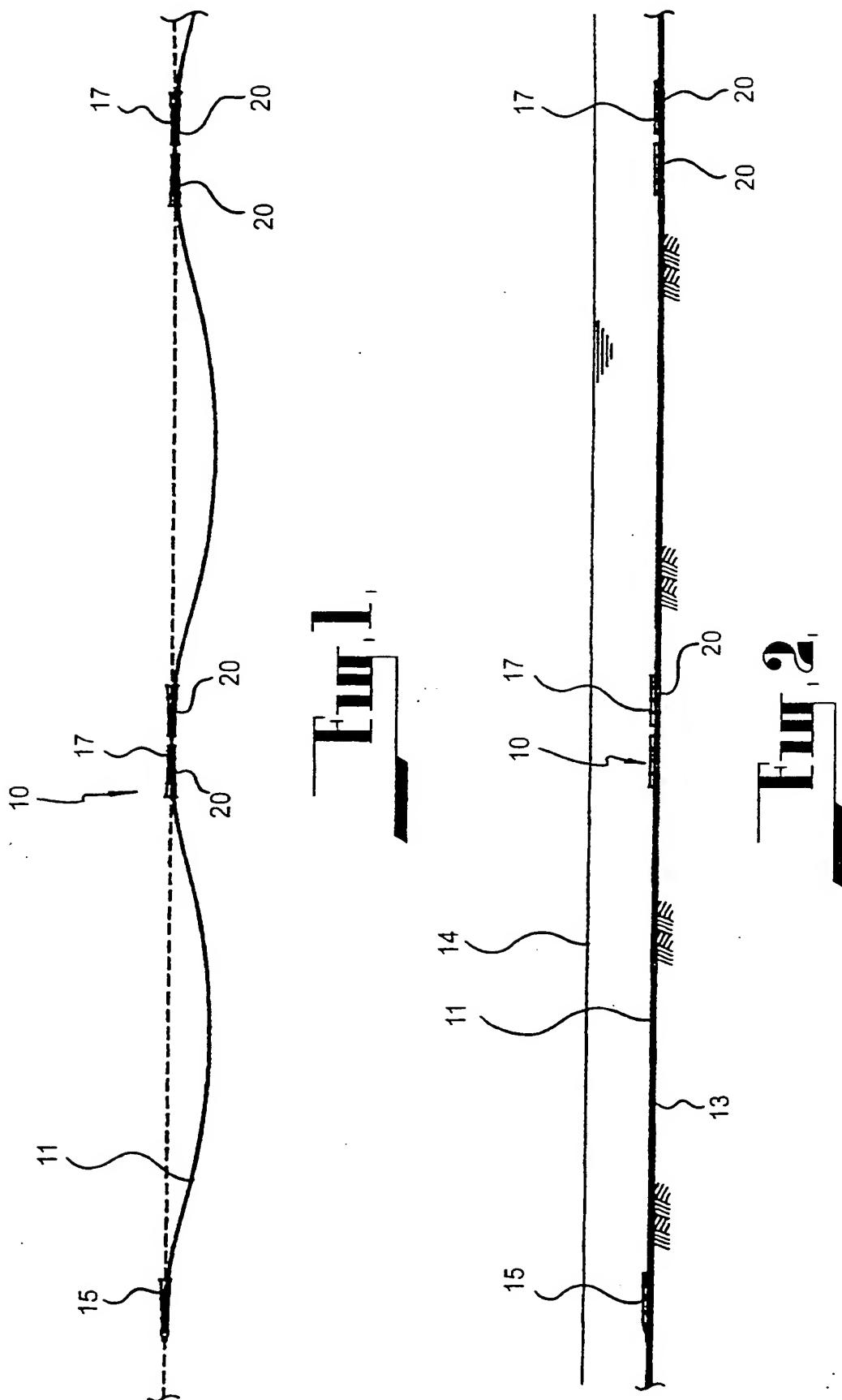
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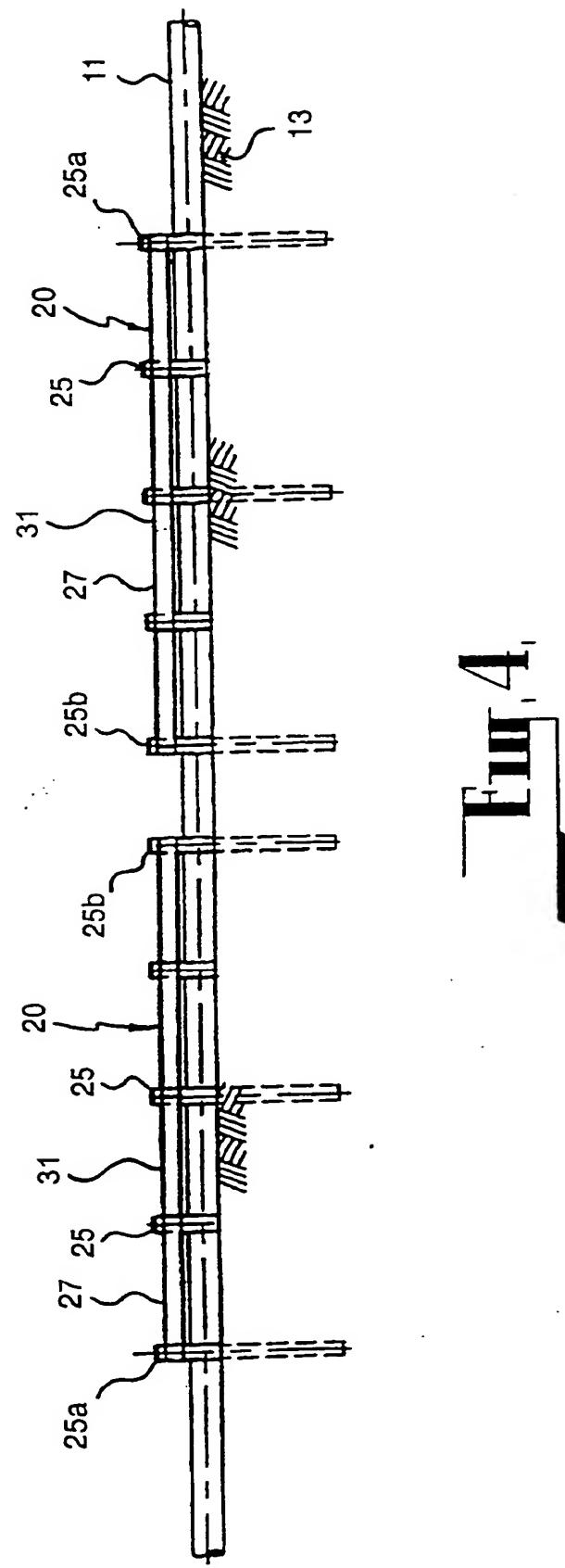
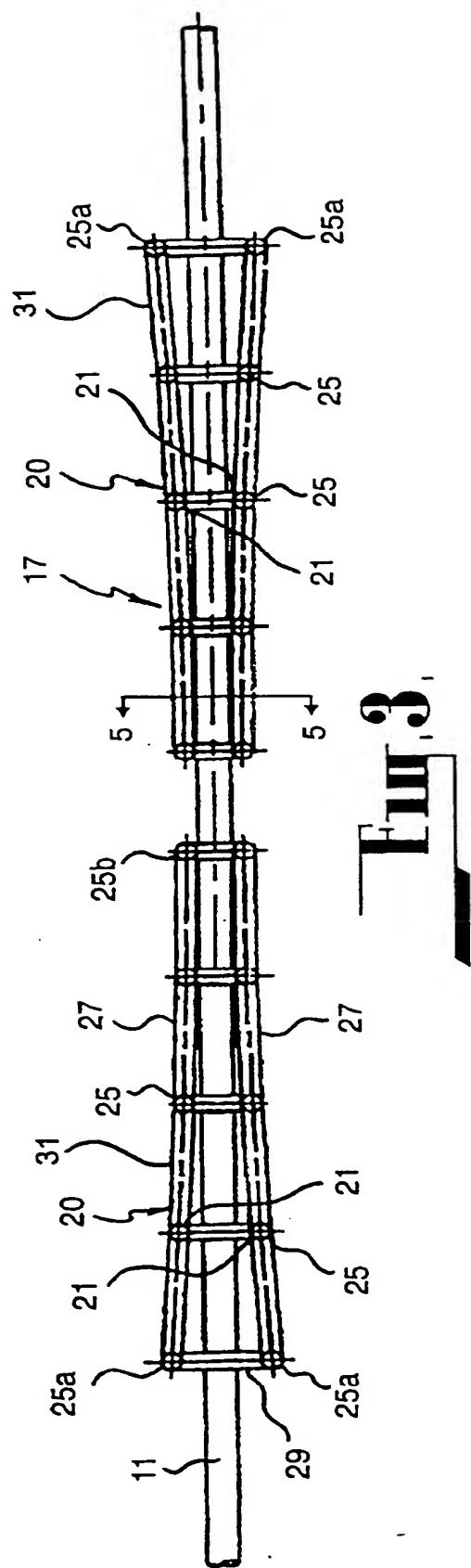
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(57) Abstract: A stabilisation system (10) for a section of a submarine pipeline (11) comprising an end restraint (15) at each end of the section of the pipeline and intermediate restraints (20) between the two end restraints (15) for limiting lateral movement of the pipeline (11) at the location of the restraints (15, 20). Each end restraint (15) is adapted to be secured to the pipeline (11) to transfer axial tension generated by lateral movement of the pipeline (11) to the seabed or ground on which the end restraint is installed. Each restraint (15, 20) comprises a pair of restraint faces (21) spaced apart to define a gap (23) through which the pipeline (11) can extend. Each restraint face (21) is configured to control curvature of the pipeline (11) during lateral movement thereof. A restraint device and a method of stabilising a submarine pipeline is also disclosed and claimed.

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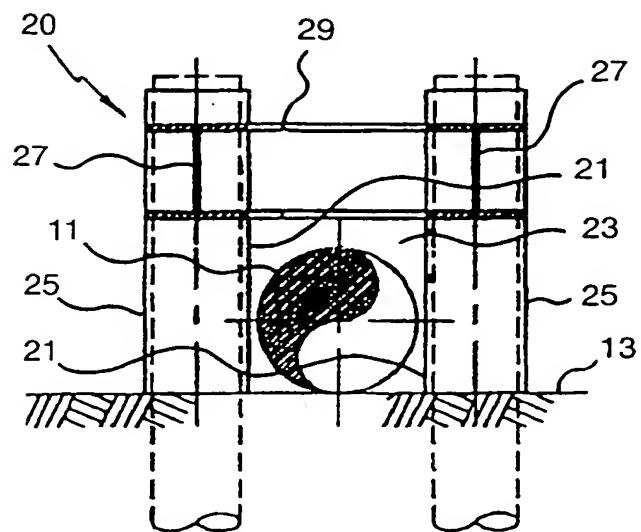


Fig. 5.

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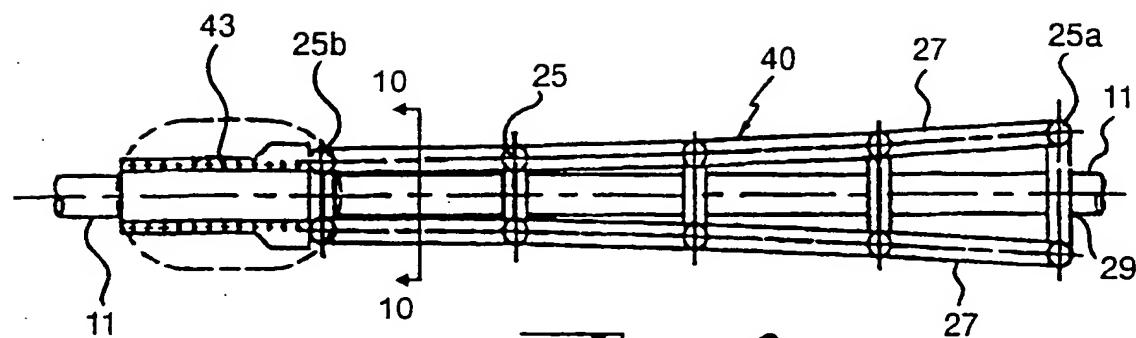


Fig. 6

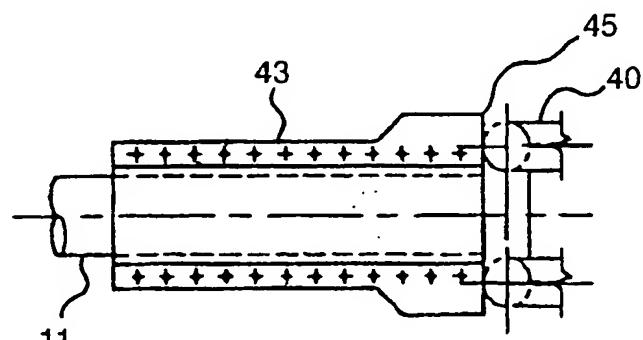


Fig. 7

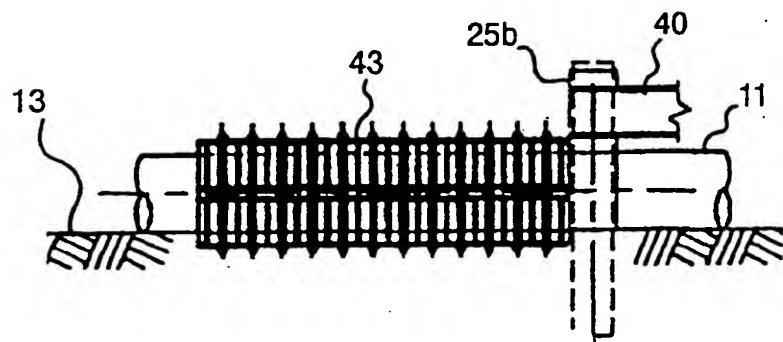


Fig. 8

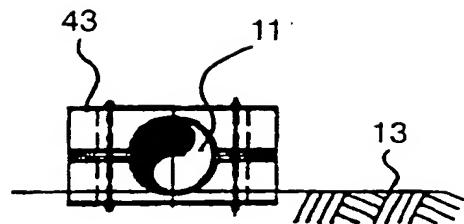


Fig. 9.

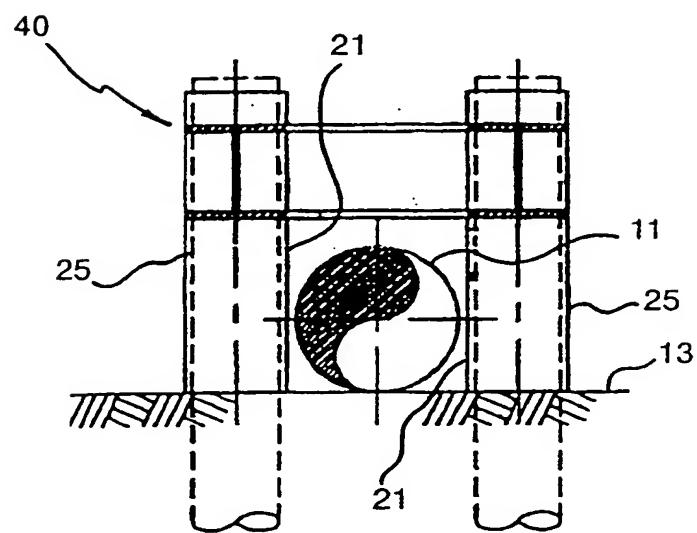


Fig. 10.